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U.S. Department of Transportation

Federal Aviation Administration

Segment Specification: Traffic Management System Automation Enhancement Phase II

1. SCOPE

There are generally three purposes for segment specifications: 1) The specification enables the government to specify the requirements for the segment to potential developers of the system. 2) The specification provides a general overview of the segment which can be used by trainers, support personnel, or other users of the system. 3) Upon government approval and authentication, the specification becomes the functional baseline for the segment. Since the TMS was an operational segment when this specification was produced, the second and third purposes shall apply to the TMS. That is, this document serves to allocate functions for Phase II and shall not be used for procurement purposes. More detailed specification documents shall be generated to document the as-built configuration for the hardware and software system elements.

This document specifies automation functions to be performed in support of Phase II of the Automation Enhancement Project to the Federal Aviation Administration (FAA) Traffic Management System (TMS). (Unless stated otherwise, 'TMS' in this document shall refer to Phase II capabilities.) The system elements required to carry out the automation functions are identified herein as either Hardware Configuration Items (HWCIs) or Computer Software Configuration Items (CSCIs). Requirements of the TMS automation are allocated to specific HWCIs and CSCIs so that separate contracting (task orders and statements of work) can be initiated for the development and implementation of any Configuration Item.

1.1 Identification

This Segment Specification establishes the requirements for TMS automation to be produced by Phase II of the TMS Enhancement Project. The specified automation includes only functionality provided under the direct operational control of the TMS. Only interface requirements are included herein for National Airspace System (NAS) automation that also supports the TMS. The automation specified herein will be referred to collectively as TMS automation.

The TMS Enhancement project shall be jointly managed by the Automation and the System Engineering Services of the FAA. The operational management of the TMS automation and the management of software development activities are the responsibility of the Air Traffic Operations Division (ATO-100) of the FAA. Phase I was complete in 1984; it increased the computing capacity available for the TMS by replacing the IBM 9020 Central Flow Control Computer (CFCC) with an IBM 4341, initiated improved data communications via the Interfacility Communications Network (IFCN), and provided automated workstations for the Central Flow Control Function (CFCF). Phase II builds on Phase I by providing automated workstations for the Traffic Management Units (TMUs), and TRACONs; functional enhancements to Phase I capabilities; and multi-

point communications and data exchange among all TMS automation system elements and related facilities. Future systems are being planned to provide the transition of TMS automation into the environment of the Advanced Automation System (AAS). This document specifies capabilities that shall be provided by automation related to the TMS Enhancement Project.

1.2 Purpose

The purposes of TMS automation are:

a. To collect all air traffic demand and capacity data pertinent to flow management.

b. To supply computing resources to analyze air traffic demand and capacity data for flow management purposes.

c. To deliver flow management information and analyses to all NAS specialists involved in flow management.

d. To provide more effective alternatives to manual and teletype procedures for coordinating and communicating flow management information.

1.3 Introduction

This specification is prepared in conformance with the document definitions appearing in DOD-STD-2167 (specifically Data Item Description DI-CMAN-80008) and the specification preparation instructions appearing in FAA-STD-005d.

Compliance and reference documents are given in Section 2. The main body of requirements for the TMS automation are given in Section 3. Sections 3.1.1 to 3.1.4 are general, system-level requirements. Sections 3.1.5 and 3.1.6 contain allocation of requirements to configuration items. Section 3.1.7 contains interface requirements. Section 3.3 is deferred for contractor completion; it is to contain a specification of the resource utilization for each configuration item. Testing requirements are given in Section 4. Section 5 identifies the responsibility for the standards for delivery of the system. Section 6 contains a list of the acronyms used in this document.

2. APPLICABLE DOCUMENTS

2.1 Government Documents

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

STANDARDS -- FAA:

FAA-STD-002	Engineering Drawings
FAA-STD-005d	Preparation of Specification Documents
FAA-STD-016	Quality Control System Requirements
FAA-STD-018	Computer Software Quality Program Requirements
FAA-STD-020a	Transient Protection, Grounding, Bonding and Shielding Requirements for Equipment
FAA-STD-021	Configuration Management (Contractor Requirements)
FAA-STD-025	Preparation of Interface Control Documents
FAA-STD-028	Contract Training Programs

STANDARDS -- MILITARY:

DOD-STD-2167	Defense System Software Development
MIL-STD-483	Configuration Management Practices for Systems, Equipments, Munitions, and Computer Programs
MIL-STD-490	Specification Practices
MIL-STD-1388-1A	Logistics Support Analysis
MIL-STD-1388-2A	DOD Requirements for a Logistic Support Program Plan (Draft)
MIL-STD-1561B	Uniform DOD Provisionary Procedures
MIL-STD-1521	Technical Reviews and Audits for Systems, Equipments, and Computer Programs

STANDARDS -- FEDERAL:

FIPS-PUB-71	Advanced Data Communication Control Procedures (ADCCP)
FIPS-PUB-100/ FED-STD-1041	Interface Between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Operation with Packet-Switched Data Communications Networks

OTHER PUBLICATIONS:

NAS-SR-1000	NAS System Requirements Specification (NASSRS)

NAS-MD-001	Subsystem Baseline Configuration and Documentation Listing
Order 1800.8e	Configuration Management
Order 1810.1	ADL Test and Evaluation Policy
Order 6040.15	National Airspace Performance Reporting System (NAPRS)
Order 7210.47	Traffic Management System
Memorandum	Air Traffic Operations Division Phase II Traffic Management Requirements, ATO-400, April 1, 1985.
Memorandum	TMU Automation Requirements, ATO-400 to APM-200, 2 Jul 84.
Briefing	ATO and APM to FAA Administrator, March 83.
Briefing	AAT-400 to APM-200, 17 Jan 84.

2.2 Reference Documents

The following documents include studies performed in support of the Traffic Management System. The contents of this document are intended to include and supersede the operational requirements analysis appearing in the documents below.

REQUIREMENTS ANALYSIS -- Computer Sciences Corporation:

Traffic Management System Enhancement Study
DTFA01-82-C-10029 June 1984

REQUIREMENTS ANALYSIS -- MITRE Corporation:

Functional Requirements for the Phase I Enhanced Central Flow Control System
WP-83W534 November 1983
Functional Requirements for Traffic Management in the AAS/AERA 1 Time Period
MTR-84W191 Revision 1, June 1985

OTHER PUBLICATIONS:

FEDSIM Report	81065-DOT AAT-400 Requirements Analysis December 1982
FIPS-PUB-78	Guideline for Implementing Advanced Data Communication Control Procedures (ADCCP) 26 September 1980
International	Standards Organization, "Reference Model of Open System Interconnection," ISO/TC97/SC16 Draft International Standard ISO/DIS/7498, 1982
FAA-E-2661a	NADIN Operation, Technical and Programming Requirements

January 18, 1984
Appendix A -- High Level Data Link Control Procedures

3. REQUIREMENTS

Requirements presented herein specify the capabilities of TMS automation during Phase II of the Traffic Management System Enhancement Project, without regard to whether the capabilities were provided by Phase II or earlier efforts. Allocation of TMS automation requirements to system elements (i.e., HWCIs and CSCIs) take into account pre-existing system architecture as well as future needs. This document states TMS automation requirements for a time frame of 1984 through 1989; specifically it is recognized that the relationship of TMS automation to the NAS is expected to change by the time of the implementation of the AAS.

3.1 System Definition

All TMS operational flow control programs shall be implemented and monitored by the Operations Division (ATO-100)of the Air Traffic Operations Service. National TMS activities shall be centered in the Central Flow Control Function (CFCF) of the Air Traffic Control Command Center (ATCCC). At each Air Route Traffic Control Center (ARTCC) and at selected Level V Terminals, the Traffic Management Unit (TMU) is the distributed component of the TMS, responsible for local traffic management at centers and terminals.

The TMS automation has five major processing elements defined as HWCIs: the Central Flow Control Computer (CFCC), the Interfacility Communications Network (IFCN), the Central Altitude Reservation Function (CARF) processor, the Enhanced Traffic Management System (ETMS), and the intelligent workstations. The intelligent workstations support the Central Flow Control Function (CFCF), the TMUs, selected TRACONs, and the Emergency Operations Facility (EOF). The CFCC and the IFCN shall be located in the Traffic Management Computer Complex (TMCC). The ETMS will be located at its development location in the Transportation Systems Center, Cambridge, Mass. Besides the TMS processing elements, the TMS shall contain controller position equipment, weather displays, and an Airport Reservation Function (ARF) terminal.

3.1.1 Missions

TMS automation supports the following primary mission-related activities of NAS specialists involved in Traffic Management:

a. Approve, disapprove or coordinate proposed traffic management restrictions between facilities.

b. Monitor the application of traffic management restrictions issued throughout the system for effectiveness and take action to cancel or modify, where appropriate.

c. Implement and manage traffic management programs when necessary, to relieve congestion and to assure the orderly flow of traffic consistent with an equitable distribution of delays.

d. Determine overall air traffic control system capacity on a continuing basis by relating the status of the NAS components and continental weather patterns which affect it.

e. Determine when the capacity of an airport or sector is, or will be, reduced and the flow management restrictions that may be required. Conference concerned facilities and coordinate the appropriate action to be taken.

f. Approve or disapprove reservations at High Density Traffic Airports (HDTAs).

g. Manage the Central Altitude Reservation Function.

h. Monitor and evaluate the overall effectiveness of the decisions made to balance system demand and capacity.

3.1.2 Threat

Threat is interpreted herein as any risk of safety loss associated with the use of the TMS automation. TMS services to TMS specialists have been categorized in NAS-SR-1000 according to the severity of impact of loss of each service on safe separation and control of aircraft. The categories are:

a. Critical. Functions or services which, if lost, would prevent the NAS from exercising safe separation and control over aircraft.

b. Essential. Functions or services which, if lost, would reduce the capability of the NAS to exercise safe separation and control over aircraft.

c. Routine. Functions or services which, if lost, would not significantly degrade the capability of the NAS to exercise safe separation and control over aircraft.

In NAS-SR-1000, Table 3-6, no TMS services are categorized as critical.

3.1.3 System Modes and States

The TMS automation shall be available to TMS specialists in an on-line mode. The real-time functional and performance requirements of the TMS automation shall be satisfied by the on-line mode unless otherwise specified herein. The CFCC and the TMU workstations shall also be available in an off-line(support) mode.

3.1.4 System Functions

General TMS automation capabilities are classified into four data handling categories that are independent of the type of data under consideration:

Data Collection and Monitoring
    Gathering data from both static and dynamic sources
Database Maintenance
    Keeping traffic management data current and correct
Analysis and Forecasting
    Supporting predictions and quantitative assessments
Distribution, Display, and Reporting
    Providing data wherever and whenever needed

The general requirements for the TMS automation shall be expressed in terms of data. Automation supporting Traffic Management is concerned with two primary types of data and five types of supporting data. Primary data for the TMS shall be demands and capacities. Demands are made on airspace and aerodrome resources by air traffic using or proposing to use those resources. Capacities are limitations on how much air traffic can safely use an airport or other saturable airspace. These capacities are a characteristic of the airports and airspaces directly or a characteristic of the work load imposed on NAS specialists. Supporting data shall be:

delay data - shall describe the observed and anticipated traffic delays
weather data - shall describe the significant features which could affect the flow of traffic
traffic management restriction data - shall describe the restrictions currently in place
system status data - shall describe the condition of the NAS equipment and resources that can affect the flow of traffic
navigation data - shall describe the physical properties of the airspace

Data may be further classified as static or dynamic. Data may also be classified as current or historical.

3.1.4.1 Data Collection and Monitoring System Function

The TMS automation shall be capable of collecting static and dynamic data concerning planned aircraft movements and concerning the anticipated capacity of the airspace system.The TMS automation shall be capable of monitoring the positions of aircraft in flight and of monitoring the status of equipment crucial to flow management.

3.1.4.1.1 Itinerary Data Collection

Itinerary data provides origin/destination and timing information that is considerably less detailed than flight plan data. Airline itinerary data shall be collected from an airline flight schedule vendor, e.g., the Official Airline Guide (OAG), and directly from the air carriers.

3.1.4.1.1.1 Static Flight Itinerary Data

The TMS automation shall be capable of accepting stable, static flight itinerary data on a regular schedule from a commercial source.

a. The TMS automation shall accept input of all U.S. air carrier flight itineraries from an airline flight schedule vendor.

b. The processing of the vendor input shall replace all former vendor itineraries.

c. Itineraries shall be identified by source as part of the flight plan data in the TMS database or databases.

d. The itinerary data shall be updated no less frequently than twice a month.

3.1.4.1.1.2 Airline and General Aviation Traffic Data

The TMS automation shall improve the quality of dynamic flight data by accepting early notification from the airline of flight itinerary additions, changes, and cancellations.

a. The TMS automation shall accept multiple flight plans and stopovers (a flight plan with more than one leg filed).

b. The automated Airport Reservation Function (ARF) of the TMS shall also accept reservations from nonscheduled operators (except helicopters) bound for high density traffic airports. Through this automation general aviation operators shall be able to make, cancel, change, and confirm their reservations without intervention from ATCCC personnel. ATCCC personnel shall be able to assist general aviation operators in entering reservation requests to the ARF automation.

3.1.4.1.2 Flight Plan Data Collection

The TMS automation shall collect flight plan data from NAS. Military and General Aviation (GA) flight plan data shall be collected from Flight Service Stations (FSSs). Flight plan data shall be received by the CFCC and ETMS from NAS. Flight plan change messages from NAS shall be sent to TMS whenever a flight plan amendment changes the route of flight or significantly changes the altitude of any Instrument Flight Rules (IFR) flight, except when an IFR aircraft is in transition for landing or departure. Minor flight plan amendments shall be reflected in terms of net effect in a single message that is sent to TMS as the flight in question leaves the airspace of any ARTCC. Flight plans, amendments, cancellations, and departure time messages shall be received from NAS by the TMU workstations for those flights originating in the local ARTCC.

3.1.4.1.3 Position Data Collection

En route position data, collected from NAS, shall describe position and other flight data sufficient to predict future aircraft positions.

a. Position data received from NAS by the CFCC and ETMS shall be monitored and compared to predicted aircraft positions on a real-time basis.

b. Position data shall be received by the CFCC and ETMS from NAS as arrival and departure messages.

c. The data block information shall be sent by NAS to the IFCN and ETMS for tracked aircraft every five minutes.

d. The results of route conversion by NAS shall be sent to its local TMU workstation in the form of postable fix times.

e. The time of each handoff from one sector to another shall be sent from NAS to its local TMU workstation.

3.1.4.1.4 Capacity Data Collection

The TMS automation shall accept capacity data from personnel at the TMUs and the ATCCC. These personnel shall use historical analyses of capacity as a source of capacity data.

a. By airport, the airport acceptance rate shall be accepted by the automation as a manual input.

b. By sector, the sector capacity shall be accepted by the automation as a manual input.

c. The capacity data shall be treated as a function of time up to 30 days in advance.

d. Changes shall be accepted, with times of application of the capacity specified to the minute.

3.1.4.1.5 Aeronautical Information Collection

3.1.4.1.5.1 System Status Data

The TMS automation shall collect system status data that describe the conditions of NAS and related equipments and facilities that can significantly affect the flow of air traffic. These data shall include sectorization data, runway configurations, and notifications and reports of equipment status.

3.1.4.1.5.2 Aeronautical Information

Aeronautical information shall be acquired or generated and maintained current by the TMS automation. This information shall include at a minimum the following, for the geographic area of NAS responsibility in the contiguous US:

a. Information concerning the establishment, condition, or change in any component of the NAS, the timely knowledge of which is essential to personnel concerned with traffic flow management.

b. Information regarding the boundaries and times of restriction for special use airspaces.

c. Information regarding preferred, fuel-efficient, and low altitude routes.

d. Information regarding alternate routing to be used to avoid conditions which preclude original route availability.

3.1.4.1.5.3 Navigation Data

Navigation data shall describe the physical properties of the airspace.

a. The TMS automation shall be capable of collecting data from the Aeronautical Information System (AIS) to describe Victor airways, Jet Routes, preferential routes, and latitude-longitude for all fixes in the air traffic control system.

b. The TMS shall be capable of accepting, and in selected cases verifying, aeronautical information from any source, including users, military and other governmental organizations, and private organizations concerned with operations or components of the TMS.

c. Aeronautical information which becomes no longer valid/relevant shall be deleted from the base of available information within one hour.

d. Aeronautical information shall be obtainable along a specified route, or in conjunction with specified positions or areas, or by reporting location.

3.1.4.1.6 System Performance Data Collection

The TMS automation shall collect data on actual versus planned traffic counts and traffic densities for Controlled Departure Time (CDT) programs, for Airport Acceptance Rates (AARs), for en route sector loadings for GA traffic, and for arrival/departure operation ratios. The TMS automation shall also collect delay information related to CDT programs and Arrival Sequencing, Departure Sequencing, and En Route Spacing Programs.

3.1.4.2 Database Maintenance System Function

a. The TMS shall store and maintain for retrieval historical demand synopses by day and/or weather conditions (manually entered), by event, by hour, and by sector, airport, fix, or airway.

b. The TMS shall maintain sectorization, staffing, and traffic capacity data to be used to determine reportable reductions of capacity with respect to expected demand.

c. The TMS shall store and maintain for retrieval historical performance of runway configurations and their associated ranges of arrival/departure capacities under various weather and equipment conditions (manually entered).

3.1.4.3 Analysis and Forecasting System Function

Estimates and forecasts shall describe anticipated future quantities of any of the other types of data, including general aviation demand estimates and forecasts consistent with historical demand patterns. Depending on the circumstances and type of data, estimates and forecasts shall be produced by computer models or by ad hoc analyses.

a. The TMS shall be capable of projecting the current and future capacity of, and demand on, any fixes, sectors, airports, or airway route segments using available data.

b. The TMS shall be capable of producing analyses of the impact of actual or potential flow management actions on the balance between capacity and demand and on the expected loading of sectors and airways.

c. The TMS shall have the capability to predict, for each aircraft associated with projections of traffic demand, the future position, altitude, and approximate speed.

d. The TMS shall also project the number of general aviation (GA) aircraft anticipated to impact the demand on airports and en route airspace.

e. Short term predictions of up to two hours shall be based on NAS surveillance data in conjunction with associated flight plan information.

f. Long term predictions shall be available for the entire route of flight, based on available flight plan information.

3.1.4.3.1 Delay Analysis

Delays attributable to Air Traffic Control (ATC) actions are composed of airborne delays and ground delays. Airborne delay is defined as the difference between the proposed time en route and the actual time en route. Ground delay is defined as any delay which ATC explicitly imposes through either a Controlled Departure Time (CDT) program or as a result of a departure sequencing program. For the purpose of measuring TMS performance, delay data shall be used to express the degree of imbalance between demand and capacity in the use of NAS airports and airspace.

Delays are typically estimated based on anticipated demand data and anticipated position data as compared to estimated capacity data, with reference to the specific TMS strategies that are being employed. Delay data shall appear in analysis of flow control programs, collection of TMS performance data, and formal delay reporting forms.

a. The TMS shall be capable of estimating future delays in either the airport or en route airspace based on anticipated demands, capacities, and flow management strategy data.

b. These delay estimates shall be available based either on the officially estimated demand and capacity values, or on hypothetical trial demand and capacity data being used for evaluation of alternatives, or on a combination of official and hypothetical data.

c. These delay estimates shall be available to all TMS specialists.

d. The TMS shall provide automated support to calculate delays based on proposed/actual departure times, Departure Clearance Times (CDTs), and en route/arrival delays attributable to ATC actions.

e. The TMS shall support CDT and Selected CDT (SCDT) program planning with the following types of analysis:

1. Sequencing analysis of all individual aircraft projected to impact an airspace or route during a specified period. The result of the analysis shall include the expected amount of delay for each individual aircraft.

2. Ground delay analysis for a specified subset of the air traffic that is expected to be affected by a congested sector or route. The subset of air traffic shall be determined based upon destination, geographical area, route, fix, altitude stratum, time period, or any combination thereof. The result of the analysis shall include the amount of unavoidable delay for each aircraft to serve as a basis for the assignment of ground delays for these aircraft.

3. Program delay analysis for all aircraft that will be subject to an actual or trial CDT. The result of the analysis shall include the sequencing analysis described above for each congested sector or route impacted by the traffic designated to be included in the CDT program.

f. The TMS shall be capable of computing delay actually imposed on flights in the ATC system based on position data received by the TMS.

g. The TMS shall be capable of comparing actual delays with predicted values of delays that were used in planning flow management alternatives.

h. The TMS shall be capable of computing "wheels-off" departure times for flights that are in contention for a common coordination fix from multiple airports, at airports to be designated by the Air Traffic Service. The resulting delays and departure time assignments shall be recorded for analysis of system effectiveness. This function shall be part of the Departure Sequencing Program (DSP).

3.1.4.3.2 Saturation Analysis

a. The TMS shall have the capability to determine actual or potential saturation of any selected airspace and/or aerodromes specified by the specialist.

b. Information shall be generated that will summarize the accumulation of traffic within the (potentially) saturated airspace.

c. On-line traffic demand data and traffic accumulation data shall be analyzed to relate traffic demand to the location of centers, sectors, fixes, and airports.

d. Saturation analysis shall be available for airways as well as for fixes and sectors.

e. The saturation analysis shall include all aircraft in the selected area.

f. The saturation analysis shall be available for all sectors in the NAS airspace, without regard to the classification of the sectors as high altitude or en route sectors.

g. En route sectors shall be adapted from 10,000 feet upwards to include shelved sectors.

h. Sector capacities shall be developed by the TMUs at the ARTCCs and maintained for all sectors.

i. Local en route sector loading predictions available at the TMU workstations shall be applicable to either current data or selected historical periods.

j. The historical data shall include actual operations counts as well as the history of predicted demand.

k. Summary display products in the form of histograms, graphic displays, maps and lists are required.

3.1.4.3.3 Capacity Analysis

The primary determinant of the capacity of the system is the weather. Specialists at the ATCCC monitor the weather conditions across the nation. Weather conditions and forecasts shall be provided to TMS specialists as charts and notices by a meteorologist at the ATCCC and as graphic displays by automated meteorological systems. National weather data and local weather data are both to be included as part of the TMS data.

3.1.4.4 Distribution, Display, and Reporting System Function

Data distribution requirements are based on the differing mission of specialists involved in national, local, or terminal traffic management.

a. The TMS automation shall provide the capability for graphical display of demand versus capacity either in the form of a screen display or as hard copy.

b. Graphical display shall also be provided for: center/sector maps, track data on maps, and traffic volume summary graphs and charts.

c. The TMS automation shall produce, print, and communicate the following kinds of reports: Airport demand, center/sector flight times, comparison of historical vs. current demand, delay summary, projected demand, actual demand, and delay histories for aircraft.

d. The TMS automation shall provide the capability to prepare, print, and communicate delay reports in NAPRS format.

e. All workstations shall provide the capability to selectively retrieve demand and capacity data based on qualification criteria submitted with the request for retrieval and display.

f. Weather data shall be displayed at each CFCF position. The weather data shall be generated by a meteorological system external to the TMS.

g. Weather data shall by displayed on stand-alone color weather radar displays at the TMU. The weather data shall be generated by a meteorological system external to the TMS.

h. Departure sequencing data in the form of coordinated "wheels-off" slots shall be displayed to tower controllers.

i. Metering lists shall be displayed to TMCs operating en route spacing program (ESP) or arrival sequencing program (ASP) positions within the TMU and in specified TRACONs. These metering lists shall be displayed on devices separate from the Plan View Displays (PVDs).

j. Altitude Reservations (ALTRVs) shall be distributed to all affected ARTCCs, and by the ARTCCs to all affected towers and Terminal Radar Approach Control Facilities (TRACONs). ALTRVs shall also be distributed to European CARF (EUROCARF) and Pacific Military Altitude Reservation Function (PACMARF). When final, non-classified ALTRVs shall be distributed to ARTCCs via the National Airspace Data Interchange Network 1A (NADIN 1A).

3.1.4.4.1 Flow Control Program Implementation Data

Traffic management restriction data describe the initiatives taken to control the flow of air traffic. More specific classes of this type of data are Departure Clearance Times (CDTs), landing slot assignments, meter fix times, flow restrictions, and ATC-preferred and preferential routes. Constraints applied to air traffic commonly include, but are not limited to, the following: no direct clearances allowed, required fix or airway, altitude limitation, speed limitation, meter fix time or boundary crossing time, miles in trail, and minutes in trail. Constraints are normally applied selectively to subsets of the air traffic in order to solve a particular traffic flow problem. Constraints are normally applied selectively to those aircraft in a general location in some time period, to aircraft having the same origin/destination, to aircraft of the same performance class, to individual aircraft by aircraft ID, or some combination of these selection criteria. Flow control planning activities can anticipate resolutions by preparing ATC-preferred maneuvers for traffic subject to flow constraints.

The TMS automation shall provide automated support of authorized flow control programs.

a. There shall be support for Fuel Advisory Departure programs on either a trial basis (FADT: Fuel Advisory Departure - Trial) or permanent basis (FADP: Fuel Advisory Departure - Permanent).

b. The TMS automation shall maintain authorization information that identifies the specialists who are permitted to initiate a flow control program.

c. CFCF specialists shall be authorized to initiate a program for designated national airports.

d. TMU specialists located at an ARTCC shall be authorized to initiate a program for airports and other congested airspaces within that ARTCC.

e. The TMS automation shall provide the capability to identify for a flow control program flights which qualify for inclusion in the program; qualification shall be determined by the filed intention to land at a particular airport during a time period when demand is predicted to exceed capacity.

f. Upon the initiation of a flow control program, the TMS automation will issue Departure Clearance Times (CDTs) pertaining to all qualifying flights that have not yet been cleared for take off.

g. The TMS automation shall provide the capability to calculate the CDTs applicable to all qualified flights for which flight plan data are available at the time of initiation of a program; this capability shall be applicable to either a FADT or a FADP.

h. The TMS automation shall provide the capability in the case of a FADP to automatically notify NAS to issue departure delays as determined by the calculated CDTs.

i. The TMS automation shall provide the capability in the case of a FADP to issue equitable and appropriate delays to aircraft that qualify for inclusion in a flow control program after the initiation of that program. Appropriate delays shall be determined such that demand will not be expected to exceed the capacity during the time of the program.

j. The TMS automation shall automatically collect actual departure, arrival, and en route timing data for flights involved in a program and to associate all such data with the predicted flight plan and estimated position data used in planning the program and issuing flow control directives.

3.1.4.4.2 Flow Management Data

a. Flight information, airway/route usage, flight data summarized as to time and position, and real-time flight data (e.g., cancellations, diversions and delays) shall be available to all specialists.

b. Traffic Management Coordinators (TMCs) shall be provided NAS central flow information summaries including current flow restrictions in effect throughout the NAS and traffic loading information summarized by time and fix, sector, airway/route, or boundary crossing points.

c. If airspace or aerodromes are or will be saturated, the traffic management system shall have the capability to allocate available airspace or aerodrome capacity, determine flight restrictions for specific aircraft, and communicate these restrictions and alternative courses of action via ground communications facilities to airlines, military, and general aviation users and specialists.

3.1.4.4.3 Traffic Projection Displays

a. The TMS automation shall provide the capability to project on a large screen display all graphics produced on the CFCF workstations or the TMU workstations.

b. The display capability shall provide graphic presentation of comparisons of demand and capacity for airports, sectors, fixes, and airways.

c. The CFCF display capability shall provide the display of aircraft positions shown against geographical outlines to include all NAS airspace from a national scale down to individual fixes, sectors, airports, and airways. The display capability at the TMU shall provide the display of aircraft positions in the local ARTCCs and the adjacent ARTCCs shown against geographical outlines to include fixes, sectors, airports, and airways. Selection capability shall be provided in the creation of graphics products for these displays so that only the traffic of immediate interest appears on the screen.

d. There shall be the capability to select the time or time range that applies to the display of traffic positions.

3.1.4.4.4 Position Data

a. Short term predictions of aircraft position shall be available to all specialists on request, selectable according to origin and destination, type of aircraft and air carrier, intersection with particular sectors or airways, and time restrictions of any of the above selection criteria.

b. The estimated time of arrival for all aircraft shall be updated dynamically as pertinent position information is received by the TMS automation.

c. The best estimated time of arrival for any aircraft shall be available to the TMU at the ARTCC where the aircraft is scheduled to land.

d. Long term predictions of aircraft position shall be available for the entire filed route of flight, similarly selectable.

e. Either short term or long term predictions of aircraft position shall be available to a requesting specialist within 10 seconds of the request.

3.1.4.4.5 Estimates and Projection Data

a. Information products from the analysis functions described in the Analysis and Forecasting System Function section shall be made available to specialists.

b. IFR traffic capacity and demand projections shall be available to all TMS automation specialists.

c. Capacity and demand projections shall be provided selectively by sector, airway route segment, and aerodrome.

d. Capacity and demand projections made on request shall deliver results to the requesting specialist within 10 seconds of a request.

e. The TMS automation shall be capable of projecting for specified aerodromes and runways the numbers of arrivals and departures that can be handled and the number of planned arrivals and departures.

f. The TMS automation shall provide the number of planned arrivals and departures of IFR traffic projected in the future at a specific aerodrome or runway.

g. Aerodrome future demand projections shall be provided for up to 30 days in advance.

3.1.4.4.6 Alert Messages

a. TMS automation shall provide the capability to predict saturation of airspace or aerodromes up to eight hours in the future from the time of request using the best information available at the time of the prediction.

b. TMS automation shall provide the capability to issue saturation advisories when the saturation prediction indicates that such an alert is appropriate.

c. TMS automation shall be capable of supplying sector workload information for selected look-ahead times up to eight hours in the future.

d. Additional saturation predictions shall be made based on short term estimates of aircraft position as known by the NAS.

e. These short term saturation predictions shall be available to Traffic Management Coordinators in summary report form up to 2 hours in advance of the present.

3.1.5 System Functional Relationships

TMS automation system functions, Data Collection and Monitoring, Database Maintenance, Analysis and Forecasting, and Distribution, Display and Reporting, have been previously described in Sections 3.1.4.1 - 3.1.4.4. The relationship among these functions is shown in Figure 3-1.

3.1.6 Configuration Allocation

Each Hardware Configuration Item and Software Configuration Item and the functions performed by each are described below.

3.1.6.1 CFCC HWCI

On-line processing and off-line system development and support shall be performed by a centralized computer system located in the TMCC at the FAA Technical Center (FAATC) in New Jersey.The CFCC shall provide the appropriate redundancy and interconnects to insure a system with the specified reliability. The CFCC HWCI shall implement the CFCC CSCI functions defined in Section 3.1.6.15.

3.1.6.2 IFCN HWCI

Essential communications functions shall be provided by IFCN processors located in the TMCC at the FAATC. The IFCN shall:

a. Serve as an internetwork communications gateway for messages from and to:

1. NAS
2. Selected AFTN and ARINC addressees
3. CFCC
4. Data Systems Specialist (DSS)/Programmer consoles
5. ATCCC, TMU, and EOF workstations
6. Monitor Console

b. Manage all necessary protocol conversion;

c. Provide a switching capability to allow flexibility and backup;

d. The IFCN HWCI shall implement the IFCN CSCI functions defined in Section 3.1.6.16.

3.1.6.3 Monitor Console HWCI

There shall be three monitor consoles. The primary and one backup shall be located at the ATCCC and the second backup shall be located at the TMCC. The monitor console shall provide a single point of control for the IFCN in the event of IFCN degradation. The console shall have the same hardware configuration as a TMS workstation. The console HWCI shall implement the monitor console CSCI functions defined in Section 3.1.6.17.

3.1.6.4 TMS Workstations HWCI

The ATCCC, TMUs, TRACONs and the EOF shall be equipped with intelligent workstations. The workstations in the ATCCC, TMUs and EOF shall have a multiprocessing capability and shall provide the capability to generate color text and graphic displays, interface with the NAS, the IFCN, and other input/output devices. The TMU workstations shall be able to remote metering lists to other locations within the ARTCC. The TRACON workstations shall have a multiprocessing capability and shall provide the capability to generate monochrome text and graphic displays, interface with the TMUs in their associated ARTCC, and other input/output devices. Each workstation shall include a disk storage device with at least 70 MB capacity and a printer capable of reproducing the display image. The TMS Workstation HWCI shall implement the CSCI functions defined in Section 3.1.6.18 for the CFCF Workstations and in Section 3.1.6.19 for the TMU and TRACON Workstations.

3.1.6.5 CFCF Weather Display HWCI

Weather displays available at selected CFCF positions shall consist of a six-color monitor, data receiver, and color printer. The system shall display single-site weather radar (including doppler radar data), mosaic display of regional weather, and weather data received from satellite sources. Choice of radar or satellite display for all positions shall be selectable by CFCF personnel.

3.1.6.6 TMU Weather Radar Display HWCI

Weather displays available at selected TMU positions shall consist of a six-color monitor, data receiver and color printer. The system shall display single-site weather radar (including doppler radar data), mosaic display of regional weather, and weather data received from satellite sources. Choice of radar or satellite display for all positions shall be selectable by TMU personnel.

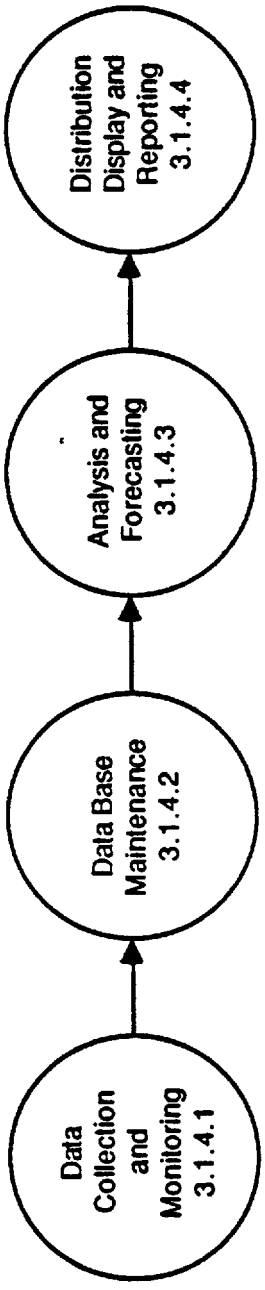

FIGURE 3-1
TMS AUTOMATION FUNCTIONAL RELATIONSHIPS

3.1.6.7 Sector Controller Equipment HWCI

There shall be a complement of sector controller equipment in each ARTCC adapted for use by the TMU. The equipment shall include, up to five NAS Plan View Displays (PVDs), if available, computer readout devices, computer entry devices, flight strip printers and Input/Output Typewriters (IOTs) and shall be located in the area that has been designated as the TMU area on the operations floor.

3.1.6.8 System Development and Maintenance Workstations HWCI

To provide CFCC system development and maintenance support there shall be TMS and 3270-equivalent workstations and printers located at the TMCC and 3270-equivalent workstations, personal computers and printers located at the ATCCC. To provide IFCN system development and maintenance support there shall be VT100-equivalent workstations and printers located at the ATCCC.

3.1.6.9 Metering List Display HWCI

There shall be metering list displays located in the TMU area at the ARTCCs and in specified TRACONs. These displays shall be output devices only.

3.1.6.10 Departure Sequencing Display HWCI

There shall be departure sequencing input/output devices located in designated tower cabs. There shall be a maximum of 72 such cabs . The actual sites shall be designated by the Air Traffic Service.

3.1.6.11 CARF HWCI

The CARF processor shall be located at the TMCC. CARF workstations located at the ATCCC shall consist of high resolution color graphics displays and associated printer shaving graphic output capabilities. The CARF HWCI shall implement the CARF CSCI functions defined in Section 3.1.6.18.

3.1.6.12 AVARS HWCI

The AVARS workstation shall be located in the ATCCC and shall consist of a monochrome alphanumeric display terminal.

3.1.6.13 ETMS HWCI

The ETMS central processors will be located at TSC and shall consist of distributed processors.

3.1.6.14 ETMS CSCI

The ETMS shall provide monitor alert and aircraft situation display functions.

3.1.6.15 CFCC CSCI

The following functions shall be allocated to the CFCC computer software.

a. The operational functions of the CFCC shall:

1. Maintain a database that includes flight identification, departure and destination information, route of flight information, for both scheduled and non-scheduled flights;

2. Update the database in accordance with flight plans, departure messages, update messages, amendments, cancellation messages, and arrival messages received from NAS and manual changes to or cancellation of flight plans made by the CFCF traffic managers;

3. Update the database as a consequence of running simulations and assigning delays as part of a CDT program;

4. Temporarily change the status of flights by inhibiting or activating their consideration in reports or simulations;

5. Update the database by changing the landing capacities, general aviation estimates, and sector capacities;

6. Estimate arrival delays at selected airports with selected demands;

7. Produce CDT programs in both a test mode and in an operational mode;

8. Produce benefit analysis reports which list the detailed delay estimates per individual flight, the aggregate ground and airborne delay expected, the estimated cost savings of ground holding, airborne holding cost, gallons of fuel saved on the ground and burned in the air;

9. Produce a System Analysis Recording (SAR) and Archive Log Queue (ALQ) Recording on disk;

10. Be capable of carrying out data storage and retrieval operations on disk storage devices by performing at least 35 I/O operations per second;

11. Store and maintain for retrieval historical demand synopses by event and/or weather conditions (manually entered), by day and be hour, for sectors, airports, fixes or airway segments.

b. The support functions of the CFCC shall:

1. Support system development activities by providing editing, compiling, and input/output functions;

2. Support system generation by providing library maintenance, environment adaptation, system build, and system data assembly functions;

3. Support system testing by providing test case generator and test director functions;

4. Support system auditing by providing code auditor, certification, and data reduction and analysis functions;

5. Be capable of carrying out data storage and retrieval operations on disk storage devices capable of performing at least 35 I/O operations per second.

6. Run under the IBM MVS operating system.

3.1.6.16 IFCN CSCI

The following functions shall be allocated to the IFCN computer software.

a. NAS Message Transmission which shall provide for the transmission of messages received from the NAS En Route Centers to the CFCC. Specifically the IFCN shall:

1. Receive messages from the NAS centers;

2. Determine the version level of the NAS center (2.14 or more recent, or otherwise);

3. Error check and receipt for NAS messages;

4. Respond to test requests from NAS;

5. Forward flight plan, departure time, cancellation, arrival time, boundary crossing, amendment, and data block messages from NAS to the CFCC;

6. Filter flight-related data messages from being forwarded to the CFCC as specified by personnel using privileged workstations;

7. Send a control time message to NAS when a flight is determined to be eligible for an CDT.

b. Controlled Departure Time (CDT) Message Generation and Transmission which shall provide for the generation of CDT messages and the transmission of those messages to the NAS En Route Centers. Specifically the IFCN shall:

1. Create and maintain CDT tables based on simulations run on the CFCC such that integrity and recovery can be insured in case of IFCN degradation;

2. Generate control time messages based on the CDT tables and flight plan messages received from NAS.

c. Traffic Manager Message Transmission which shall provide for the management of messages to and from the TMS workstations. Specifically the IFCN shall:

1. Route report requests from the ATCCC, TMU, or EOF workstations to the CFCC;

2. Route reports from the CFCC to the requesting ATCCC, TMU, or EOF workstation;

3. Route messages from the ATCCC, TMU, or EOF workstations to selected AFTN and ARINC addressees;

4. Process the CDT tables from the ATCCC or EOF workstations so that they can be used in the CDT processing;

5. Route general messages including those whose content is in binary code between any two workstations in the system.

6. Route alert messages generated by the CFCC to the appropriate ATCCC, TMU or EOF workstations.

7. Route messages indicating the status of the system elements to all TMS workstations.

d. System Monitoring and Reconfiguration which provides the mechanism for supervisory flow control personnel to configure the system in response to changes in communications loads, outages and processing requirements. Specifically the IFCN shall:

1. Maintain NAS line activity counters by message type;

2. Maintain the status of all the processors (workstations, CFCC, IFCN) and communication lines (AFTN, ARINC) in the system.

e. AFTN/ARINC Message Processing which shall provide the routing of AFTN/ARINC messages. Specifically the IFCN shall:

1. Route all incoming AFTN and ARINC messages to a printer in the ATCCC;

2. Provide a capability to retrieve any AFTN and ARINC messages initially routed to a printer and route it to the requesting workstation;

3. Route advisory and general messages from any TMS workstation to AFTN;

f. Common interface protocols and standard message formatting and retransmission capabilities to facilitate future interfaces.

3.1.6.17 Monitor Console CSCI

There shall be a master system monitor console located in the ATCCC that will monitor critical elements of the TMS. Backup system monitor consoles will be located at the ATCCC and in the TMCC. Specifically the monitor console software shall:

a. Continuously monitor all operational elements of the CFCC, IFCN, communication processors, and electronic switches;

b. Provide a single display of the status of multiple independent processes;

c. Provide automatic system reconfiguration of the IFCN in the event of a computer or disk failure;

d. Alert the DSS to any TMS system failures.

3.1.6.18 CFCF Workstations CSCI

The CFCF workstation software shall:

a. Have access, through the IFCN, to all flow control computers to retrieve data maintained in those computers;

b. Have access, through the IFCN, to incoming messages and to data from the ARTCCs' computer systems;

c. Have the ability to transfer or to access data to and from other workstations in the ATCCC, EOF or TMUs;

d. Have the ability to edit and to transmit, through the IFCN, messages directed to the ARTCCs, selected AFTN and ARINC addressees, and other workstations in the system;

e. Have the ability to recall flow control information previously stored in the workstations or in the IFCN processor;

f. Have the ability to display text and graphics simultaneously on the same display;

g. Have the ability to dynamically update graphic displays showing aircraft positions or statistical data based on update and amendment messages received by the TMS.

h. Produce, print, and communicate the following kinds of reports: Airport demand, center/sector flight times, demand comparison of historical vs. current, delay summary, scheduled demand, projected demand, actual demand, impact predictions, and delays including proposed flight plan information. The data shall be displayed by time increments as requested by the TMS specialists.

i. Retrieve and store historical demand synopsis from the CFCC database for demand vs delay/workload comparisons.

3.1.6.19 TMU and TRACON Workstations CSCI

The TMU automation shall provide analytical and display capabilities to support the Traffic Management Coordinators in balancing demand and capacity, local flow planning, monitoring the flow situation, and collecting and reporting flow management performance data. The TRACON workstations shall be capable of performing many of the same functions, although displaying data in monochrome, and shall have access to the same data as the TMU workstations at their associated ARTCC through that TMU workstation unless specified otherwise. Specifically, the TMU workstation software shall:

a. Retrieve and store historical demand synopses from the CFCC database for demand vs delay/workload comparisons.

b. Maintain sectorization, staffing, and traffic capacity data to be used to determine reportable reductions of capacity with respect to expected demand;

c. Provide software to support the selection of alternate routes based on known or forecasted weather data and to support evaluation of sector traffic forecast as alternate routes are analyzed;

d. Provide the capability of dynamically displaying graphical presentations of demand/volume on center/sector maps and traffic volume summary graphs and charts;

e. Provide the capability to display meter list information generated by NAS on a remote meter list display device.

f. Produce, print, and communicate the following kinds of reports: Airport demand, center/sector flight times, demand comparison of historical vs. current, delay summary, scheduled demand, projected demand, actual demand, impact predictions, and delays including proposed flight plan information. The data shall be displayed by time increments as requested by the TMS specialists.

g. Provide the capability to prepare, print, and communicate delay reports in NAPRS format;

h. Provide the capability to use real-time data from the NAS computer to determine acceptable departure times at selected airports for selected flights, which shall control the rate of flow for traffic over a coordination fix. This function shall be implemented only at designated TMU workstations and shall be part of the DSP.

i. Provide the capability to receive, store, archive and retrieve the following data:

   1. Demand data collected via interfaces to the CFCC, the collocated NAS computer, and other communicated messages as appropriate to demands for airports, sectors, fixes (by altitude), airways (by altitude), and facilities;

   2. Delay data including metering delays, departure sequencing delays, and CFCF CDTs;

   3. Operational log data including local operational data and the information contained in FAA form 7230-4;

4. Historical demand data detailed by day of week, time of day, weather conditions (manually entered), sector, airport, fix and airway. Such demand information shall include proposed and active flight plans to be retrievable by sector, fix, or airway;

5. Facility configuration data summarizing sectorization, staffing, and other facility status information;

6. Capacity information including nominal (or expected or assigned) values as well as temporarily adapted values for both hourly and instantaneous capacities for airport capacity/acceptance rates, for sectors, for fixes, and for facilities, and assigned and expected runway configurations for identified airports within the facility;

7. General information data, weather information, special lists, system status, and data on trial routes and preferred routes.

3.1.6.20 CARF CSCI

The TMS shall provide the capability for a Central Altitude Reservation Function (CARF) that supports flow planning and conflict-free scheduling of aircraft operations requiring other than standard ATC separation. Specifically, the CARF software shall:

a. Receive altitude request messages from military base operations users;

b. Perform format checking of input data, allowing user correction of erroneous data;

c. Perform reasonability checks of aircraft flight paths, allowing user correction of erroneous data;

d. Perform conflict detection among flights input by a given user, allowing modification of conflicting flights;

e. Assist CARF specialists in the ATCCC with conflict detection among flights of different missions, allowing modification of conflicting flights;

f. Prepare mission approval messages.

3.1.7 Interface Requirements

Interfaces are required to support information gathering, coordination and other functions. In addition to interfaces among the TMS elements: CFCC, IFCN, the monitor console and the workstations; there are additional requirements for external interfaces with NADIN 1A, NAS automation, the flight itinerary vendor, the meteorological data vendor, and military flight operations. Common interface protocols and standard message formatting/retransmission capabilities will be provided to facilitate future interfaces, including the interfaces to CNS and to other systems as yet undefined.

The communications systems architecture for the TMS shall be specified in terms of the International Standards Organization Open System Interconnection (ISO-OSI) Reference Model.

3.1.7.1 External Interfaces

3.1.7.1.1 External System Description

The following are the external systems which shall interface with the TMS:

a. NAS: Besides its normal flight plan processing and radar tracking functions, NAS shall provide the TMS with metering information, real time flight data, and track data blocks displayed on a "see-all" PVD at the TMU sector equipment complement. The flight data shall include:

1. Filed route of flight.

2. Origin and destination airports with proposed departure time and estimated time en route.

3. Estimated times and altitudes at postable fixes within the center.

4. Actual departure and arrival times.

5. Actual times and altitudes at postable fixes.

6. Notice of flight plan amendments that will change the sector boundary crossings, make significant changes in altitude, or significantly change the flight timing.

7. Notice of flight cancellation.

8. Track data block information every five minutes on all IFR flights.

The metering information shall include:

1. The aircraft identification and computer identification.

2. The identification of the current controlling sector or facility.

3. The vertex time of arrival.

4. The tentative or actual calculated vertex time.

5. The total delay.

6. The exit sector identification for each flight.

7. The metered airport name.

8. The vertex name.

9. The vertex arrival rate.

10. A freeze indicator.

b. AFTN/ARINC: The TMS shall provide the following capabilities regarding AFTN and ARINC messages:

1. There shall be a provision for addressing inbound AFTN and ARINC messages to the CFCC or workstations at the TMU or ATCCC.

2. ATCCC workstations shall be able to send a message to any legitimate addressee of ARINC, including the sending of a single message to multiple addresses.

3. Any workstation shall be able to send a message to any legitimate addressee of AFTN, including the sending of a single message to multiple addressees.

4. ATCCC messages transmitted to and received from AFTN or ARINC shall be subject to automatic printing at the ATCCC.

5. Messages received from AFTN and ARINC shall be retrievable on request by any TMS workstation.

6. The TMS shall be capable of exchanging airport utilization data and scheduled airline data with appropriately equipped airline dispatch offices.

7. Specific messages types to be transmitted over this interface shall include Flow Advisory (FA) messages.

c. Flight Itinerary Vendor: The flight itinerary vendor collects, compiles, and distributes the itineraries of scheduled airlines. The TMS shall receive the compilation of itineraries no less frequently than twice a month.

d. Meteorological Data Vendor: The meteorological data vendor collects, processes, and distributes weather data. The TMS shall be a subscriber of this service.

e. Military Units: The flight operations of the military services plan and execute large scale missions and special operations which require coordination. The TMS shall receive the military flight plans, coordinate them, and send back the approved flight plan to the military.

f. AVARS: Nonscheduled flights (except helicopters) bound for designated high traffic airports require reservations. The TMS shall receive these reservations from the Automated Voice Reservation System (AVARS). The TMS shall also receive changes and cancellations of the reservations and provide confirmation of the reservations to the general aviation operators.

g. Aeronautical Information System: The National Flight Data Center (NFDC) collects and validates aeronautical flight planning data, updating the on-line Aeronautical Information System (AIS) data base. The AIS formats and disseminates, via hard copy and magnetic tape, aeronautical data at 56 day intervals. The TMS shall be a subscriber of the magnetic tape data service.

3.1.7.1.2 External Interface Identification

Interfaces external to the TMS are identified in Figure 3-2.

3.1.7.1.3 Hardware-to-Hardware External Interfaces

The following specifies the high-level functions provided by the hardware interfaces to external systems. The detailed specifications (i.e., voltages, tolerances, loads, speeds) shall be specified in the Interface Control Documents (ICDs) listed in NAS-MD-001.

a. NAS: There shall be four interfaces with the NAS: one through its display channel and three through its Peripheral Adapter Module (PAM). The display channel interface shall connect to the plan view displays available at the TMU sector equipment complement. The communications over this interface shall be two-way. One PAM interface shall use Interfacility Output/Input (INTO/INTI) adapters to connect with the IFCN. This interface shall be two-way. Another PAM interface shall use a General Purpose Output (GPO) adapter to connect with the TMU workstation. This interface shall be one-way from the NAS to the TMU workstation. The third PAM interface shall use a General Purpose Output and Input (GPO/GPI) adapter to connect with the peripheral equipment (IOT, printer, etc.) at the TMU sector equipment complement. These interfaces shall generally be two-way.

b. AFTN/ARINC: The interface with AFTN and ARINC shall be via a 2400 bps full-duplex synchronous modem connected to the IFCN.

c. Flight Itinerary Vendor: The interface with the flight itinerary vendor shall consist of a nine-track magnetic tape drive.

d. Meteorological Data Vendor: The interface with the Meteorological Data Vendor shall be a one-way composite video circuit.

e. Military Units: The interface with the military shall be via dial-up modems attached to the CARF processor.

f. AVARS: The interface with AVARS shall be via a dial-up modem.

3.1.7.1.4 Hardware-to-Software External Interfaces

The specification of the hardware-to-software interface items(e.g., word lengths, message formats, etc.) shall be found in the ICDs for each particular interface.

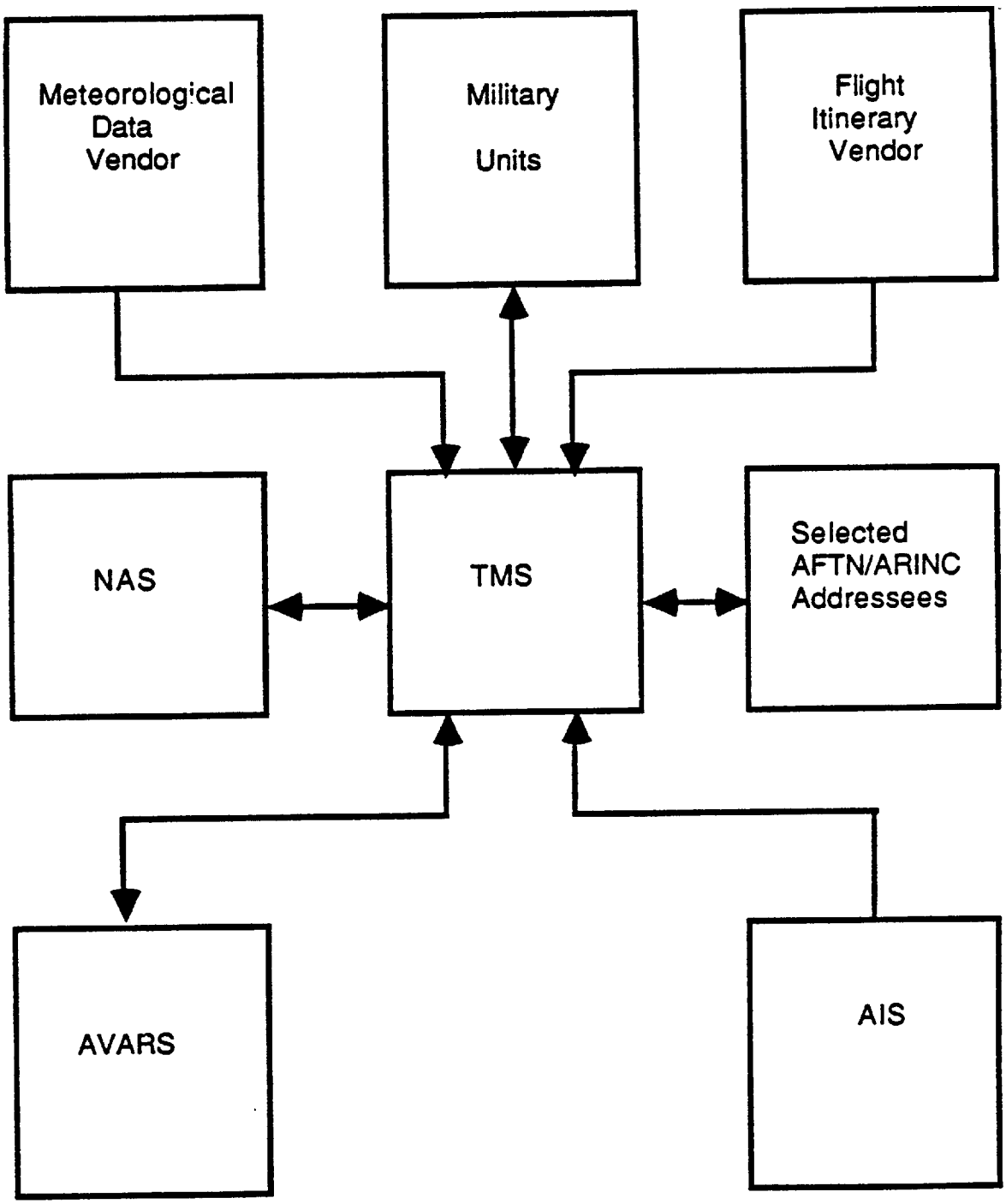

FIGURE 3-2
EXTERNAL SYSTEMS INTERFACE DIAGRAM

3.1.7.1.5 Software-to-Software External Interfaces

The specification of the software-to-software interface items(e.g., data formats, frequency of transfer, etc.) shall be found in the ICDs for each particular interface.

3.1.7.2 Internal Interfaces

IFCN shall supply network data handling services to the rest of the TMS. Priorities shall be established in the operational software for handling message traffic in the IFCN and the CFCC. The first priority shall be given to messages to or from the CFCF workstations. The second priority shall be given to the TMU workstation and the NAS messages. Within either priority, messages shall be processed in first-come, first-served order. Relative priorities for any other types of message traffic shall be determined if necessary.

There shall be a direct interface between the TMU workstations and the departure sequencing displays in the designated tower cabs.

There shall be a direct interface between the TMU workstations and the metering list display within the TMU and in specified TRACONs.

3.1.7.2.1 Internal Interfaces Identification

Interfaces internal to the TMS are identified in Figure 3-3.

3.1.7.2.2 HWCI-to-HWCI Interfaces

The CFCC shall deliver status information to the IFCN that is sufficient in detail and timeliness that the IFCN has an accurate report of the status of the CFCC available in real-time. The CFCC shall receive from the IFCN status information about other major elements in the TMS.

The CFCF workstations and the TMU workstations shall receive status data update messages sufficiently often that each workstation has an accurate reflection of the status of the TMS at any time. There shall be no requirement for voice coordination for a TMU or CFCF specialist to determine whether a specific system element is available.

The interface between the TRACON workstations and the TMU workstations at their associated ARTCC shall be via a dedicated communication line.

Specific internal hardware-to-hardware interface parameters (e.g., voltages, tolerances, speeds, etc.) shall be specified in the appropriate Interface Control Documents (ICDs) listed in NAS-MD-001.

3.1.7.2.3 HWCI-to-CSCI Interfaces

Specific internal hardware-to-software interface parameters (e.g., protocols, word lengths, bits per second, etc.) shall be specified in appropriate Interface Control Documents (ICDs).

3.1.7.2.4 CSCI-to-CSCI Interfaces

Specific internal software-to-software interface parameters (e.g., data format, etc.) shall be specified in the appropriate Interface Control Documents (ICDs).

Flow management data related to ongoing flow restrictions shall be available to CFCF workstations and TMU workstations to ensure the availability of accurate data at the workstation immediately on request. Specifically, when a restricted traffic flow program is in effect, the status of CDTs in support of the program shall be available to the specialist managing the program.

There shall be a capability to download software to a TMU workstation from an authorized workstation elsewhere in the TMS. The download capability shall include either the transmission of source code or the transmission and reconstitution of object code.

3.1.8 Government Furnished Property List

Not applicable.

3.2 System Characteristics

3.2.1 Physical Requirements

Access to the TMCC, ATCCC, and CARF shall be controlled by security-locked doors. The TMU and EOF access shall be determined by the facilities in which they are located.

Communications security shall be provided by direct point-to-point communications lines.

3.2.2 Environmental Conditions

This section is not applicable to this specification.

3.2.3 Nuclear Control Requirements

This section is not applicable to this specification.

3.2.4 Materials, Processes, and Parts

This section is not applicable to this specification.

3.2.5 Electromagnetic Radiation

The requirements for TMS equipment shall be governed by FAA-STD-202a.

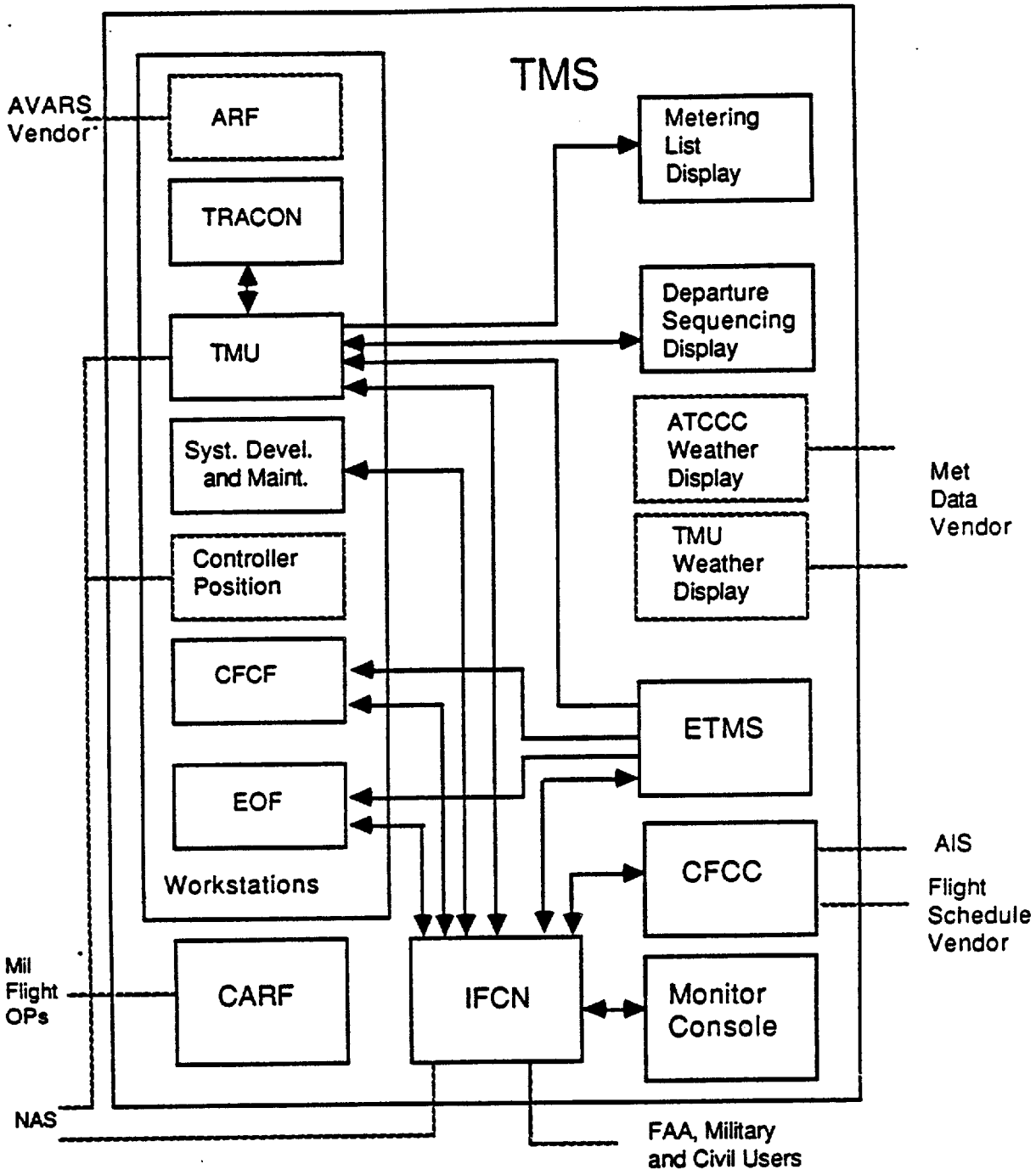

FIGURE 3-3
INTERNAL SYSTEM INTERFACE DIAGRAM

3.2.6 Workmanship

This section is not applicable to this specification.

3.2.7 Interchangeability

The CFCF, TMU and EOF workstations shall be capable of running the same computer software.

3.2.8 Safety

Safety issues related to the installation and use of TMS equipment shall be the responsibility of the facility chief for the facility where the equipment is located.

3.2.9 Deployment Requirements

There shall be:

a. Three TMU workstations including printers at each TMU, except the TMU at the New York TRACON which will receive two workstations;

b. Two color weather radar displays including color printers at each TMU;

c. One TMCC/Monitor console workstation at the TMCC;

d. Nine CFCF workstations including printers at the ATCCC;

e. Nine support terminals at the ATCCC;

f. Three support printers at the ATCCC;

g. Nine support terminals at the TMCC;

h. Two support printers at the TMCC;

i. Five development and maintenance terminals at the ATCCC;

j. Two development and maintenance printers at the ATCCC;

k. Two Monitor Consoles at the ATCCC;

l. EOF workstations at the EOF;

m. Four weather terminals at the ATCCC;

n. One ARF workstation at the ATCCC.

o. Up to five sector equipment complements, if available at each TMU.

p. One TRACON workstation at selected TRACONs.

q. Up to six metering list display(s) at each TMU.

r. Departure sequencing display at up to 72 designated tower cabs.

3.2.10 System Effectiveness Models

TMS system effectiveness shall be quantitatively analyzed by measuring delays. Aircraft arriving at a congested airport or encountering congested en route airspace often suffer delays. The TMS shall be responsible for the collection of data sufficient to determine the amount of delays incurred by all flights subject to air traffic control. The TMS shall provide the capability for analyses to determine what delays are the result of air traffic control actions. The TMS shall be responsible for reporting the amount of delay incurred by all traffic, the amount of delay due to air traffic control actions, and the amount of delay due to a categorization of specific sources of air traffic control delays.

3.2.10.1 Failure Mode/Critical Assembly Analysis

The TMS shall be supported by a study of the vulnerability of the operational TMS to failure of individual equipment items. The study shall describe what loss of operational functionality results from designated categories of failure of each major equipment item used in the TMS. The study shall further identify what items of equipment are especially critical to the provision of required levels of service, and make recommendations for developments or purchases to reduce the vulnerability of the TMS to equipment failure. This study shall be prepared as a document to become part of the configuration management baseline of the operational TMS.

3.3 Processing Resources

Processing resources requirements are appropriate for the five major computer processing elements of the TMS automation: the CFCC, the IFCN, the ETMS, the workstations, and the CARF processor. The detailed requirements for these computer systems shall be completed by the appropriate contractors as part of the design and development effort. The outline of the applicable specifications are included here for completeness.

3.3.1 CFCC Processing Resource

3.3.1.1 Computer Hardware Requirements

3.3.1.2 Programming Requirements

3.3.1.3 Design and Coding Constraints

3.3.1.4 Computer Processor Utilization

3.3.2 IFCN Processing Resource

3.3.2.1 Computer Hardware Requirements

3.3.2.2 Programming Requirements

3.3.2.3 Design and Coding Constraints

3.3.2.4 Computer Processor Utilization

3.3.3 Workstations Processing Resource

3.3.3.1 Computer Hardware Requirements

3.3.3.2 Programming Requirements

3.3.3.3 Design and Coding Constraints

3.3.3.4 Computer Processor Utilization

3.3.4 CARF Processing Resource

3.3.4.1 Computer Hardware Requirements

3.3.4.2 Programming Requirements

3.3.4.3 Design and Coding Constraints

3.3.4.4 Computer Processor Utilization

3.4 Quality Factors

3.4.1 Reliability

3.4.1.1 Reliability Definition

Equipment reliability is specified herein by requirements on the Mean Time Between Failures (MTBF). MTBF is defined in MIL-STD-721 as "the mean number of life units during which all parts of the item perform within their specified limits, during a particular measurement interval under stated conditions." The relevant life units for TMS equipment are operating hours. Therefore, MTBF is computed by dividing the total equipment operating hours for items of a given type by the number of equipment failures, during a given measurement time interval.

3.4.1.2 Reliability Requirements

3.4.1.2.1 ATCCC Equipment Reliability

Equipment items yet to be procured are upgraded ATCCC workstations, including printers. The required mean time between failures for the workstation equipment shall meet or exceed:

Item	MTBF (hrs)
Workstation, 190 MB Disk	1200
Printer	7000

3.4.1.2.2 TMCC Equipment Reliability

The following minimum equipment subset is required for TMCC operation:

At least two (of four) communications network processors, each of which includes a CPU controller, and one (of two) disks.

The minimum acceptable MTBF for each equipment unit shall be 4360 hours.

3.4.1.2.3 TMU Equipment Reliability

The required Mean Time Between Failures for the workstation equipment including the printers, Departure Sequencing Displays, and Metering List Displays shall meet or exceed the following requirements:

Item	MTBF (hrs)
Operations Workstation, 190 MB Disk, PAM Interface	1200
Serial Expansion Unit	17000
Analysis Workstation, 70 MB Disk	1780
Printer	7000
DSP Terminal	3760
Metering List Display	4000

3.4.2 Modifiability

3.4.2.1 Maintainability

Maintainability is defined as a characteristic of design and installation which is expressed as a statistical measure that an item will be retained in or restored to a specified condition within a given period of time, when maintenance is performed in accordance with prescribed procedures and resources. The statistical measures specified for this system relate to the downtime of the system. Maintenance downtime is the total time during which the equipment is not in condition to perform its intended function if that equipment failed during the time period when it was scheduled to be operational. This definition of downtime includes logistics supply delay time and administrative delay time.

To meet the operational requirements for system availability specified in Section 3.4.3, the mean and maximum downtimes specified below shall be met. Mean downtime (MDT) is computed by dividing the total unscheduled downtime for equipment items of a given type by the number of equipment failures, during a given measurement interval. Maximum downtime is the longest unscheduled downtime occurring during the measurement interval.

All unscheduled downtime shall be counted against the availability regardless of the cause.

The allowable equipment downtimes are given below:

a. ATCCC workstations. Allowable downtime for the workstation vary depending on how many workstations have become inoperative:

Number Inoperative	Maximum Downtime
1	48 hours
2 or 3	24 hours
4 or more	8 hours

b. TMCC. The mean downtime for the required minimum subset of processors, disks and controllers is 24 hours and the maximum downtime is 48 hours.

c. TMU. If any single workstations becomes inoperative, allowable maximum downtime is 48 hours; allowable mean downtime is 24 hours. If both operations workstations are not operational, at least one must be repaired within a maximum of 24 hours. Any inoperative Departure Sequencing Display, TRACON workstation or Metering List Display must be repaired within a maximum of 24 hours.

3.4.2.2 Flexibility and Expandability

The existing CFCC is not capable of supporting all the functions specified herein. Replacement of the CFCC shall be sized to accommodate the specified functions plus additional functions which will allow transition to the Traffic Management Processor (TMP).

As more workstations are added to the TMS beyond those presently available, the number of available ports or the processing power of the IFCN may no longer be adequate. Therefore, any modifications to or replacement of the IFCN shall be sized to accommodate the level of message loads expected through the transition time period to the TMP.

3.4.3 Availability

3.4.3.1 Availability Definition

Availability specifies the degree to which a given segment function shall be in an operable and committable state at any unknown (random) time. It is a statistical measure giving the average fraction of time that the required equipment elements are functioning; that is, availability is defined as the total time that the required equipment elements are functioning divided by the total time interval measured.

The equipment shall be available 24 hours per day, seven days per week. Hardware and software failures are expected to occur; however, fault detection, isolation, and recovery procedures along with judicious functional partitioning shall be used to provide the essential services for the maximum amount of time.

The following subsystems of the TMS are capable of normal operation when the specified equipment complements are operative; there are no acceptable degraded modes of operation for these subsystems. An operational outage of a subsystem exists during the time when the required equipment is not operational.

3.4.3.2. Availability Requirements

a. ATCCC Workstations. At least 0.99 for at least six (of ten) workstations being operative at one time. Operative printers can be moved as needed from one workstation to another.

b. TMCC. At least 0.99 for the required minimum subset of processors, disks and controllers.

c. TMU. Separate availability requirements are specified for different subsets of the equipment located in the center:

1. 0.90 for all three workstations and printers
2. 0.95 for at least two workstations and printers
3. 0.97 for at least one operations workstation and printer.

The above specified availabilities shall include the following equipment items which interface with the center equipment:

1. all workstations located in associated TRACONs
2. at least two (of three) Metering List Displays
3. at least five (of six) Departure Sequencing Displays.

3.4.3.3 IFCN Automatic Reconfiguration

There shall be a capability to automatically reconfigure the IFCN in the event of the failure of a CPU or disk device. The reconfiguration shall be accomplished without the aid of an operations specialists performing manual actions at the FAATC. The reconfiguration shall be under the direction of the Data Systems Specialists monitoring the IFCN from the ATCCC. The reconfiguration shall include automatic reassignment of interfaces via an electronic switch. The CPU and the disk shall be considered to fail as a unit for the purposes of reconfiguration, but there shall be fault isolation provided to identify the specific CPU or

disk that was the failed unit. The reconfiguration shall be designed to provide recovery of communications and applications service within one minute. There shall be no major hardware procurements based on this requirement.

3.4.4 Portability

All workstation equipment items, except the CARF and ARF workstations and the sector equipment complements available at the TMU shall be capable of running the same software, although there may be locally adapted configurations that may be approved as part of the installation.

3.4.5 Additional Quality Factors

The TMS automation shall monitor the status of all system elements at frequent intervals. Status messages shall be sent to all TMU workstations, CFCF workstations, and EOF workstations immediately on detection of the failure of any system element. Status Messages shall be sent to all workstations on restoration of service for any system element.

3.5 Logistics

3.5.1 Support Concept

A Logistics/Maintenance plan currently is being prepared, in consonance with the National Airspace Integrated Logistics Support (NAILS) program plan. Various maintenance concepts will be analyzed, including full contractor support, vendor lease, and government depot support management.

Based on decisions reached after consideration of the results of the aforementioned analysis, various contract vehicles or support documents shall be developed and employed to execute maintenance support efforts for all TMS, CARF and ARF workstations, metering list and departure sequencing displays and other TMCC and ATCCC computing equipment.

3.5.2 Support Facilities

3.5.2.1 Hardware Support

Support equipment requirements will be developed as a result of the selected support and any vendor inputs.

A study involving APM-160 and the Project Office shall be conducted to address the procurement of hardware documentation sufficient to evaluate any hardware modifications to assure that there are no adverse effects as a result of the modifications.

3.5.2.2 CSCI Support

ATO-100 shall provide required CSCI support (e.g., debuggers, performance measuring tools, etc.) using software tools developed or provided by the software contractor.

3.5.3 Supply

Supply support requirements shall be developed after the support concept is selected.

3.5.4 Personnel

Realistic workload estimates shall be developed with consultation and coordination with APM-130 staff. Workload estimates shall include the TMCC, ATCCC and TMU components of the system in its various growth and evolutionary phases now defined.

3.5.5 Training

The training program for TMCs shall include operational TMC input/output training and analysis TMC input/output training as well as training on the fundamentals of the TMS workstation processing environment. Training will be accomplished by the most cost-effective means available.

Depending on the maintenance concept chosen, training may also be required for Airway Facilities (AF) personnel on the fundamentals of the TMS workstation operating system including specifics of diagnosing system problems to a level appropriate to the maintenance plan.

If training is contractor-developed, the contractor shall develop and conduct applicable training course(s) in accordance with contract requirements and FAA-STD-028, Contract Training Programs.

3.6 Precedence

The requirements of this document are intended to be a consistent statement of the needed automation for the Traffic Management System

Phase II project. To the extent that there are inconsistencies of presentation or interpretation, there are general precedence relationships among the requirements. Requirements mandating performance of a TMS system-level function shall be honored over requirements allocating specific functions to automated components of the TMS. Requirements mandating accomplishment of a system-level mission shall be honored over requirements for specific quantitative levels of performance. Requirements for distribution or availability of information shall be honored over specific rules for formatting or selection of method of delivery.

4. QUALIFICATION REQUIREMENTS

4.1 General

This section defines the requirements for verification of the TMS requirements in Section 3 of this specification.

4.1.1 Philosophy of Testing

The TMS verification philosophy requires the evaluation of all specified functional, performance and interface requirements in conformance with FAA Order 1810.1.

Development Test and Evaluation (DT&E) is that testing performed for design assistance, technical risk assessment and specification performance verification. DT&E provides an early look at the design and at how well the system can be expected to perform.

The principal objective of Operational Test and Evaluation (OT&E) is to explore and resolve critical operational and technical issues. System evaluation is an integral part of OT&E and is based on a comparison of operational test measurements to explicit pre-established quantitative and qualitative criteria that describe the operational requirements. Interfaces shall be considered to be part of the system for operational testing and shall be exercised with the system. OT&E emphasizes operational realism in the test environment.

Product Acceptance Test and Evaluation (PAT&E) is testing performed to ascertain that a production system has been fabricated properly and that it thereby satisfies the specifications to which it was built.

4.1.2 Location of Testing

Verification of subsystem performance will be performed primarily during factory level testing as part of DT&E and PAT&E. TMS system compatibility will be verified during installation and integration testing at the FAATC or the site of first installation as part of OT&E. This will include operational demonstrations to evaluate the man-machine interface and the quality of the logistics, maintenance and training programs.

4.1.3 Responsibility for Tests

This subparagraph establishes the overall TMS program verification responsibilities.

4.1.3.1 TMS Program Manager

The TMS Program Manager shall be responsible for all TMS program verification activities. The actual direction of the verification activities may be delegated.

4.1.3.2 Contractor Testing

Individual contractors shall be responsible for developmental testing and for supporting system integration testing and site acceptance testing. For turnkey activities, the contractor shall be responsible for site acceptance testing. The vendor shall use facilities designated by the program manager for the tests. The FAA has the right to witness or to separately perform all verification activities.

4.1.3.3 Contractor Quality Assurance Requirements

The contractor shall establish and maintain a Quality Control/Quality Assurance system in accordance with FAA-STD-016, beginning with subsystem development and continuing through contractor site acceptance activities. For subsystems using software or firmware, the contractor shall establish and maintain a Quality Control/Quality Assurance program in accordance with FAA-STD-018.

4.1.4 Qualification Methods

This subparagraph describes the qualification methods to be used in verifying each Section 3 requirement and the rationale for their selection.

4.1.4.1 Inspection

4.1.4.1.1 Hardware

Inspection of hardware is defined as a method of verification of physical characteristics that determines compliance without the use of special laboratory equipment, procedures, items or services. Inspection is used to verify construction features, document and drawing compliance, workmanship and physical condition. The success criterion for inspection shall be pass/fail.

4.1.4.1.2 Software

Software inspection is examination, without the use of special laboratory equipment or procedures, to determine compliance with requirements. This examination includes review of software source listings to verify compliance with software documentation, requirements and coding standards as well as verification of the implementation of required mathematical equations. The success criterion for inspection shall be pass/fail.

4.1.4.2 Test

4.1.4.2.1 Hardware

Hardware test is defined as a method of verification wherein performance is measured during or after the controlled application of functional and/or environmental stimuli. Measurements require the use of laboratory equipment, procedures, items and/or services.

4.1.4.2.2 Software

Software test uses technical means, including evaluation of functional operation with special equipment or instrumentation, simulation techniques and the application of established principles and procedures, to determine compliance with requirements. Test performance is the means of creating data for detailed analysis. The analysis of data derived from test is an integral part of the activity.

4.1.4.3 Demonstration

4.1.4.3.1 Hardware

Hardware demonstration is defined as a method of verification denoting the qualitative determination of properties of an end item or component by observation. Demonstration is used without special test equipment or instruction to verify such characteristics as operational performance, human engineering features, service, access features and transportability. Demonstrations shall be used to indicate pass/fail conditions.

4.1.4.3.2 Software

Software demonstration is limited to a readily observable functional operation to determine compliance with requirements (e.g., the proper response at a site as a result of a specified interrogation or command to be processed by the program). Demonstration is primarily used for activities where data gathering is not appropriate, such as CRT display verification. Demonstrations shall be used to indicate pass/fail conditions.

4.1.4.4 Analysis

4.1.4.4.1 Hardware

There are three methods of hardware analysis:

a. Engineering analysis. This type of analysis is usually an engineering design function and involves study, calculation or modeling of the known or potential failure modes and reaction or interaction of the specified parts, material and processes, and the design configuration with the known function, performance and/or probable effects of the operational environments. This analysis is normally used to verify margin when it is not desirable to test to failure.

b. Similarity analysis. Similarity analysis is a method applied to end items or components that are identical in design and manufacturing processes to end items or components that have been previously qualified to equivalent or more stringent requirements.

c. Validation of records analysis. Validation of records analysis is a method of verification wherein manufacturing records are used to verify compliance of concealed construction features or processes of manufacturing (e.g., vendor items).

4.1.4.4.2 Software

Software analysis is the processing of accumulated results and conclusions, intended to provide proof that the verification of a requirement, or requirements, has been accomplished. The analytical results may be composed of interpretation of existing information or derived from lower level tests, demonstrations, analysis or examinations.

4.1.5 Test Levels

This subparagraph defines four qualification levels. These levels, Subsystem Testing, System Integration Testing, System Testing, and System Installation Testing, shall be used to emphasize the level of testing during which specific requirements are to be verified and the method of verification to be applied.

4.1.5.1 Subsystem Testing

This level of verification shall be conducted at the contractor's facility. It culminates in the acceptance testing of a configuration item. TMS subsystem requirements should be verified to the maximum extent practical at this level to avoid the more costly correction of design flaws discovered later during TMS System Integration testing.

4.1.5.2 System Integration Testing

This level of verification testing is conducted during DT&E by the contractor to confirm that the computer software configuration items and the hardware configuration items perform in accordance with their interface requirements. These tests shall be conducted at the contractor's facility.

4.1.5.3 System Testing

This level of verification testing is conducted during OT&E to determine that the hardware and software to be deployed for site installation will perform in a TMS environment in accordance with system level operational and performance requirements. Individual contractors shall be responsible for this verification, assuring that their hardware or software functions as specified with simulated and/or actual inputs. TMS System Testing involves the operational verification of the subsystem after it is placed in its TMS environment. It shall be conducted at the FAATC and/or the site of first installation.

4.1.5.4 System Installation Testing

This testing emphasizes the demonstration of overall system performance requirements. Demonstration and inspection are the methods most often employed during this level, which includes end item site final acceptance testing.

4.2 Formal Tests

To be supplied.

4.3 Formal Test Constraints

To be supplied.

4.4 Qualification Cross Reference

To be supplied.

5. PREPARATION FOR DELIVERY

The software development cycle for the TMS Enhancement Project shall be as specified in DOD-STD-2167. The configuration management procedures shall be those ordered by FAA Order 1800.8e. ATO-100 shall specify the desired medium, format, labeling and packaging requirements for software delivery.

The system hardware shall be delivered by the vendor to the sites specified by the FAA packaged according to accepted industry practices. The vendor shall demonstrate that the hardware performs properly using the standard hardware tests for the equipment.

6. NOTES

Packaging these requirements for contracting purposes is a separate issue and shall be addressed through management plans and contractor statements of work. The following acronyms are used in the body of the specification.

ACRONYM	MEANING
AAR	Airport Acceptance Rate
AAS	Advanced Automation System
AF	Airway Facilities
AI	Amend Itinerary Message
AIS	Aeronautical Information System
ALQ	Archive Log Queue (Recording)
ALTRV	Altitude Reservation
ARF	Airport Reservation Function
ARTCC	Air Route Traffic Control Center
ASP	Arrival Sequencing Program
ATC	Air Traffic Control
ATCCC	Air Traffic Control Command Center
AVARS	Automated Voice Airport Reservation System
CARF	Central Altitude Reservation Function
CBI	Computer Based Instruction
CDT	Controlled Departure Time
CFCC	Central Flow Control Computer
CFCF	Central Flow Control Function
CI	Cancel Itinerary Message
CNS	Consolidated NOTAM System
COMPOOL	Communications Pool
CSCI	Computer Software Configuration Item
DOD	Department of Defense
DOT	Department of Transportation
DSP	Departure Sequencing Program
DSS	Data Systems Specialist
EIA	Electronic Industry Association
ELOD	En Route Sector Loading (Program)
EOF	Emergency Operations Function
ESP	En Route Spacing Program
EUROCARF	European CARF
FAA	Federal Aviation Administration
FAATC	FAA Technical Center
FADP	Fuel Advisory Departure -Permanent
FADT	Fuel Advisory Departure - Trial
FEDSIM	Federal Computer Performance Evaluation and Simulation Center

FI	Flight Itinerary Message
FIPS	Federal Information Processing Standards
FOB	Federal Office Building
FSDPS	Flight Service Data Processing System
FSS	Flight Service Station
GPO	General Purpose Output (Adapter)
HWCI	Hardware Configuration Item
HDTA	High Density Traffic Airport
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
IFCN	Interfacility Communications Network
IFR	Instrument Flight Rules
INTO/INTI	Interfacility Output/Input (Adapter)
IOT	Input/Output Typewriter
ISO	International Standards Organization
NADIN 1A	National Airspace Data Interchange Network 1A
NAPRS	National Airspace Performance Reporting System
NAS	National Airspace System
NASSRS	NAS Systems Requirements Specification (NAS-SR-1000)
NOTAM	Notice to Airmen
OAG	Official Airline Guide
OSI	Open System Interconnection (Reference Model)
PACMARF	Pacific Military Altitude Reservation Function
PAM	Peripheral Adapter Module
PVD	Plan View Display
SAR	System Analysis Recording
SCDT	Selected Controlled Departure Time
TMC	Traffic Management Coordinator
TMCC	Traffic Management Computer Complex
TMP	Traffic Management Processor
TMS	Traffic Management System
TMU	Traffic Management Unit
TRACON	Terminal Radar Approach Control Facility

10. APPENDIXES

There are no appendixes to this specification.